

STATE OF COLORADO

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Jane E. Norton, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

MEMO

TO: Vasquez Boulevard/I-70 Site Working Group Members

FROM: Jane Mitchell, CDPHE

DATE: March 10, 2000

RE: Arsenic testing information

As a follow-up to the biomonitoring conference call last Monday, I have put together a packet of some of the materials we have developed for the Globe Medical Monitoring Program, including information on the analytical methods used for arsenic testing, the participant questionnaire and portions of the testing protocol.

As a result of comments and suggestions made by Joyce Tsuji during the conference call, we plan to update our questionnaire to include an additional question about how long it has been since the participant last had their hair cut. We will also have our advisory group consider adding two other questions to ask about the amount of rice and the amount of organ meats people typically eat.

Please let me know if I can furnish any other information to the work group.

PARTICIPANT QUESTIONNAIRE – PAGE 1

Patient ID:
(Attach label here)

Baseline Questionnaire

STATUS:			
<input type="checkbox"/> Baseline		<input type="checkbox"/> Voluntary (If voluntary, check one of the following)	
<input type="checkbox"/> Remediation		<input type="checkbox"/> Worker	
		<input type="checkbox"/> Former Resident	
		<input type="checkbox"/> Other	
NAME:			DATE: / /
Last	First	Middle Initial	Month Day Year
HOME ADDRESS:			
Street:		City:	
State:		Zip:	County of Residence:
Has participant been tested since 1994 through Globeville Medical Monitoring Program?		If yes, address when last tested?	
<input type="checkbox"/> Yes <input type="checkbox"/> No			
Name of person responding to questions if participant is a child:			
How long has participant lived or worked in the footprint area: (See map)		Home Telephone No.: ()	
Yrs. Mos.			
Participant's Age:		Birth Date: / /	
Month Day Year			
Participant's Sex: <input type="checkbox"/> Female <input type="checkbox"/> Male		Maternal Conditions:	
		Pregnant Woman <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	
		Nursing Woman <input type="checkbox"/> Yes <input type="checkbox"/> No	
Race Ethnicity:		What is the participant's race?	
Is the participant Spanish/Hispanic/Latino?		<input type="checkbox"/> White <input type="checkbox"/> American Indian or Alaska Native	
<input type="checkbox"/> No, not Spanish/Hispanic/Latino		<input type="checkbox"/> Black <input type="checkbox"/> Vietnamese	
<input type="checkbox"/> Yes, Mexican/Mexican American/Chicano		<input type="checkbox"/> Korean <input type="checkbox"/> Asian or Pacific Islander	
<input type="checkbox"/> Yes, other Spanish/Hispanic/Latino		<input type="checkbox"/> Some other race (please print)	
Hair treatments:			
Within the past 10 weeks have you used any hair treatments such as:			
Dandruff shampoo		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Hair color or dye		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Permanents, or other chemical processing, cold-wave treatments, or straighteners?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
What brand of shampoo do you use?			
Smoking:			
Does participant currently smoke cigarettes or other tobacco products (such as chewing tobacco or smoking a pipe/cigars)?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Has participant ever smoked cigarettes or other tobacco products?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does anyone else smoke tobacco products inside your home?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Has participant eaten fish, including tuna, salmon, shrimp, oysters, crab, clams, or seafood within the past 3 days (including meals eaten out)?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Has participant consumed red wine in the past 3 days?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	
Did participant work or play outside in the Globe area neighborhood in the past few days?		<input type="checkbox"/> Yes <input type="checkbox"/> No	

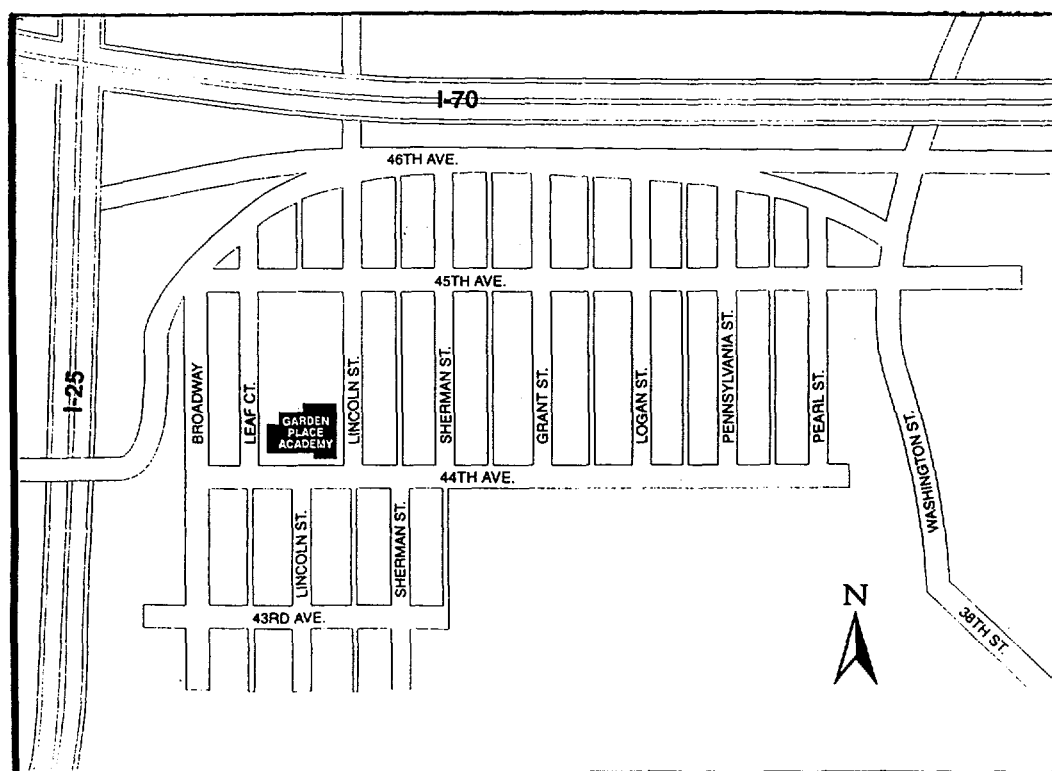
Continued on back →

PARTICIPANT QUESTIONNAIRE – PAGE 2

Patient ID:
(Attach label here)

Is the participant currently taking any prescription medications, such as antibiotics?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
If yes, complete the following:				
<u>Name of Medication</u>		<u>Reason Medication was Prescribed</u>		
Do you currently use water from a well for your drinking water?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Do you eat vegetables or fruits from your own garden or from a neighbor's garden?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Occupation:		How long at occupation:		
Previous occupation:				
Do you handle metals such as arsenic, cadmium, or lead?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Is the participant taking a vitamin or dietary supplement, such as calcium or iron?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Has the participant ever been told by a physician that they have kidney disease?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Has the participant ever been told by a physician that they have diabetes or hypertension?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Do you have any other medical concerns you would like the program physician to be aware of, including skin or nerve disorders? If yes, describe:		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Name of participant's physician or primary health care provider:				
Address of physician/health care provider:				
Street:				
City:		State:		Zip:
Would you like us to mail a copy of your test results to your physician/health care provider? <input type="checkbox"/> Yes <input type="checkbox"/> No				

Consent Signed: <input type="checkbox"/> Yes <input type="checkbox"/> No	Test Location: <input type="checkbox"/> Community Resource Center <input type="checkbox"/> Concentra <input type="checkbox"/> Home <input type="checkbox"/> Other
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GLOBE MEDICAL MONITORING PROGRAM

SAMPLING PROTOCOL

29-02-00

SUBSTANCE	TUBE	PROCEDURE	STORAGE
Lead (Pb) and cadmium (Cd) in whole blood	Plastic lavender tube BD# 7863	Gently invert the tube 8 to 10 times in order to properly dissolve the anticoagulant.	Keep samples refrigerated or freeze at -20°C
Cadmium (Cd), creatinine and non-dietary arsenic (As) in urine	125 mL Nalgene bottle	Collect a random specimen. <i>Collect this specimen first, then go on to the β2-microglobulin sampling instructions.</i>	Keep samples refrigerated or freeze at -20°C
β 2-microglobulin in urine	30 mL pre-treated Nalgene bottle	Using the above urine sample, pour directly an aliquot into the 30 mL bottle filling to the shoulder. The 30 mL bottle already contains a preservative. See special notice inside the kits.	Store at 4°C , 2 days or best freeze at -20°C Avoid freezing / thawing cycles.
Arsenic (As) in hair	-----	See special instructions provided	Room temperature

Transport : Place samples in an appropriate cooler with ice-packs to keep the samples cold. Include a packing list detailing the sample IDs and nature of the specimens.

Ship to : Laboratoire de toxicologie, INSPQ
Att : Alain LeBlanc
CHUL, Local S-308
2705, Boul. Laurier
Ste-Foy, QC, G1V 4G2
Tél : (418) 654-2254 x 7648

F:\test\priv\alain\John Tessari arsenic project - sampling protocol.doc

Hair sampling



Date: _____

Last name: _____

First name: _____

ID #: _____

Centre de Toxicologie
Institut National de santé publique du Québec
2705, Boul. Laurier
Sainte-Foy, Québec
Canada, G1V 4G2
Tél: (418) 654-2254

**SEE INSTRUCTIONS
INSIDE**

INSTRUCTIONS

- It is recommended to wash the hair before sampling .
- Collect a strand of hair (0.5 cm in diameter) as close to the scalp as possible.
- **Staple** the sample in the space provided on the right page.
- Place the root end upwards.
- Close the pamphlet and insert it in a ZIP-LOC bag.
- The front cover must be visible through the plastic bag.

? Indicate the nature of the request: **general screening or specific elements.**

? Is the analysis to be done **over the entire length of the specimen, the first few centimeters, or the entire length but per centimeter?** Please be precise.

ARSENIC ONLY

_____ **4 segment analysis as follows:** _____

_____ **0-1 cm, 1-3 cm, 3-5 cm, 5-7 cm** _____

_____ **(If length of sample allows)** _____

⇒ Brand of shampoo used:

⇒ Special hair treatments:

[illegible]

- **Root end upwards**
- **Staple only**
- **The grid below is in cm²**

[illegible]

ARSENIC HAIR TESTING

- Hair testing is being offered as part of the medical monitoring program because urine analysis will not show arsenic exposure that occurred more than two to three days prior to testing.
- Hair testing can detect exposure to arsenic over the past several weeks to months, depending on the length of hair that is tested.
- Hair testing involves clipping several strands of hair (about 1/4 inch thick or roughly the thickness of a pencil) from the section of hair near the back of the neck. Every effort will be made to collect the hair sample so that it is not noticeable, if at all possible.
- Analysis of hair samples is limited in that test results may not be reliable for individuals who have recently treated, colored or processed their hair. **The laboratory will inspect each hair sample** to determine if the hair collected is a good healthy sample of hair which has not been cosmetically altered and, therefore, is suitable for analysis. You may return for a retest, if the laboratory rejects your hair sample. You will need to wait about 10 weeks or more since you last treated or colored your hair to have reliable test results.
- Neither hair nor urine tests can pinpoint the source of arsenic detected in a sample. Other exposures may occur from an individual's occupation, diet or medication. Hair samples may have high levels of arsenic due to dust that is directly taken up by the hair strand.
- The purpose of the arsenic hair test is to help identify exposure which may be occurring in your environment. These tests are not designed to tell you whether you may experience specific health problems due to arsenic exposure.
- Individuals who have an elevated test result can meet with a physician to help determine the source of the exposure and discuss their health concerns.

COLLECTION AND SHIPPING INSTRUCTIONS FOR URINE SAMPLES

USE COLLECTION EQUIPMENT SUPPLIED BY CTQ's LABORATORY

1. Do not open the Ziploc bag containing the urine collection kit until just before the sample is to be collected.
2. Provide a labeled urine collection cup to the participant along with the instruction sheet on how they should collect their specimen. Be sure an adult accompanies any child being tested into the bathroom.
3. Open the Ziploc bag and place pre-numbered labels on the 2 collection bottles.
4. Immediately after the urine specimen is returned to the collection station, transfer a portion of the urine specimen (30-50 mL) from the urine collection cup to the 125mL Nalgene bottle (the larger bottle provided in CTQ's sample kit). Pour another aliquot of urine from the collection cup directly into the 30 mL bottle (the smaller bottle provided in the CTQ kit) and fill bottle up to the shoulder. Do not touch the inside of the urine specimen container or allow it to come into contact with clothing or external surfaces. Leave the bottle caps turned up while filling the bottles.

The 30 mL bottle contains a pre-measured amount of sodium hydroxide solution for pH adjustment to prevent degradation of the beta-2 sample. Observe cautions listed on CTQ's kit for handling a corrosive material.

5. Recap the collection bottles immediately to minimize exposure to the air. Check to be sure the numbered labels on the urine collection containers match the numbers on the participant questionnaire and consent form.
6. Place bottles back in the Ziploc bag, seal the bag and refrigerate samples immediately in an upright position.
7. Place all samples in a shipping container with blue ice. Include requisition form for all samples being mailed. This form will act as the chain-of-custody for the samples being shipped. Affix air bill and shipping labels provided by the laboratories. Split (duplicate) samples are to be shipped to Quest Lab. All other samples will be shipped to CTQ. Keep copy of requisition form with date, time and initials of when the samples were transferred to the shipping company.
8. Ship samples via FedEx, between Mondays and Thursdays only, using overnight express.

HOW TO COLLECT YOUR URINE SPECIMEN

1. You will be given a labeled urine collection cup at the sample collection area. Take the cup with you into the bathroom.
2. Be very careful not to touch the inside of the container or allow the cup to come into contact with your clothing or other objects.
3. Wash your hands carefully with soap and water before you collect your sample.
4. Collect the urine sample by starting to urinate into the toilet as you normally would. Move the collection cup into the urine stream. Fill the container $\frac{1}{2}$ full or more if possible. You will need to collect at least enough urine to fill the cup to the 30 mL mark for the laboratory to be able to analyze your sample for all of the recommended tests.
5. Return the urine specimen immediately to a health care worker in the sample collection area.



ARSENIC IN HAIR -condensed version-

PM-049-A-résang

1. PRINCIPLE

Inductively coupled plasma mass spectrometry

2. USUAL WORKING RANGE

0.05 $\mu\text{g/g}$ to 10 $\mu\text{g/g}$ (higher concentrations may be determined after appropriate dilution).

3. INSTRUMENTATION

Perkin Elmer Sciex Elan 6000 ICP-MS

4. DESCRIPTION

20 mg of hair is weighed in a polypropylene tube. Unless specified, the analysis is done on one segment only (0-2 cm). The sample is digested using nitric acid for 2 hours in an 80°C water bath. Aqueous calibration is performed and results are validated with an appropriate certified reference material.

5. PRECISION, ACCURACY AND DETECTION LIMIT

Certified hair material (GBW 09101)

Target value ($\mu\text{g/g}$)	Measured mean ($\mu\text{g/g}$)	N	% RSD
0.59	0.57	26	9.0

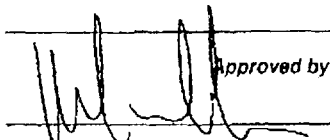
Detection limit : 0,05 $\mu\text{g/g}$.

6. NORMAL LEVELS

General population : < 0.1 $\mu\text{g/g}$.

7. REFERENCE

Method PM-049-A

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NON-DIETARY ARSENIC IN URINE
-condensed version-

M-204-C-résang

1. PRINCIPLE

Graphite furnace atomic absorption spectrometry – Zeeman background correction.

2. USUAL WORKING RANGE

0.1 $\mu\text{mol/L}$ to 5 $\mu\text{mol/L}$ (higher concentrations may be determined after appropriate dilution). This method excludes the dietary contribution that may originate from certain types of foods (ie : seafood). This method applies to arsenite, arsenate, MAA and DMAA and other types of extractable species.

3. INSTRUMENTATION

Perkin Elmer Z-5100 with Zeeman correction.

4. DESCRIPTION

1 mL of sample is extracted with toluene in the presence of potassium iodide. The toluene extract is back extracted with a solution of potassium dichromate. This solution is analysed for arsenic. Matrix matched calibration is performed.

5. PRECISION, ACCURACY AND DETECTION LIMIT

Target value $\mu\text{mol/L}$	Measured mean ($\mu\text{mol/L}$)	N	% RSD
2.2 (worker)	2.19	10	2.8
3.0 (arsenite)	3.24	10	3.8
0.9 (arsenate)	0.92	10	7.9

Detection limit : 0.1 $\mu\text{mol/L}$.

6. NORMAL AND OCCUPATIONAL EXPOSURE LEVELS

General population : < 0.25 $\mu\text{mol/L}$

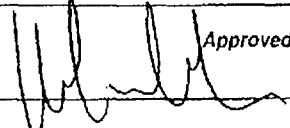
Alert level : 1.1 $\mu\text{mol/L}$

7. EXTERNAL PROFICIENCY TESTING PROGRAMS

Centre de toxicologie du Québec.

8. REFERENCE (M-204-C)

Fitchett AW, Daughtrey EH et Mushak P. 1975. Anal. Chim. Ac., 79, 93-99

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LEAD IN BLOOD

-condensed version-

M-137-B-résang

1. PRINCIPLE

Graphite furnace atomic absorption spectrometry – Zeeman background correction.

2. USUAL WORKING RANGE

0,05 $\mu\text{mol/L}$ to 5,0 $\mu\text{mol/L}$ (higher concentrations may be determined after appropriate dilution).

3. INSTRUMENTATION

Perkin Elmer ZL-4100 with Zeeman correction.

4. DESCRIPTION

100 μL of blood is diluted with 1 ml of a solution containing Triton-X 0,5%, Nitric acid 0,2 % and Ammonium phosphate 0,1 %. Calibration is performed using certified blood controls from the Quebec Interlaboratory comparison program.

5. PRECISION, ACCURACY AND DETECTION LIMIT

Target value ($\mu\text{mol/L}$)	Measured mean ($\mu\text{mol/L}$)	% RSD
0,3	0,31	2,8
1,2	1,23	2,25
2,1	2,13	1,9
2,8	2,82	2,48

Detection limit : 0,05 $\mu\text{mol/L}$.

6. NORMAL AND OCCUPATIONAL EXPOSURE LEVELS

General population : < 0,5 $\mu\text{mol/L}$.

Alert level : 1,5 $\mu\text{mol/L}$.

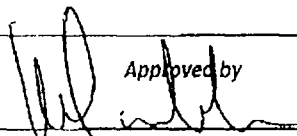
Action level : 4,0 $\mu\text{mol/L}$.

7. EXTERNAL PROFICIENCY TESTING PROGRAMS

- Centre de toxicologie du Québec.
- Centers for disease control and prevention.
- New York's State Department of Health.
- Ontario's Ministry of Health.

8. REFERENCE (M-137-B)

Parsons P.J., Slavin W. A rapid Zeeman graphite furnace atomic absorption spectrometric method for the determination of lead in blood. Spectrochimica Acta, 1993. Vol. 48B, No. 6/7, 925-939.

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CADMIUM IN URINE -condensed version-

M-198-B-résang

1. PRINCIPLE

Graphite furnace atomic absorption spectrometry – Zeeman background correction.

2. USUAL WORKING RANGE

2 nmol/L to 200 nmol/L (higher concentrations may be determined after appropriate dilution).

3. INSTRUMENTATION

Perkin Elmer Z-5100 with Zeeman correction.

4. DESCRIPTION

1 mL of diluant (dilute nitric acid) is pipetted into autosampler cups. 100 μ L of urine is then added and mixed with the diluant solution. Matrix matched calibration is performed.

5. PRECISION, ACCURACY AND DETECTION LIMIT

Target value (nmol/L)	Measured mean (nmol/L)	N	% RSD
40	39	10	4.7
150	148	10	1.6

Detection limit : 2 nmol/L (or 0.2 μ mol/mol creatinine).

6. NORMAL AND OCCUPATIONAL EXPOSURE LEVELS

General population : < 10 nmol/L
Alert level : 75 nmol/L
Action level : 225 nmol/L

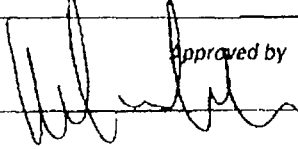
7. EXTERNAL PROFICIENCY TESTING PROGRAMS

➤ Centre de toxicologie du Québec.

8. REFERENCE (M-198-B)

HALLS, BLACK, FELL and OTTAWAY

Direct Determination of Cadmium in Urine by Electrothermal Atomic Absorption Spectrometry. J. of Analytical Atomic Spectr., 2 (1987) pp. 305-309.

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CADMIUM IN BLOOD -condensed version-

M-205-B-résang

1. PRINCIPLE

Graphite furnace atomic absorption spectrometry – Zeeman background correction.

2. USUAL WORKING RANGE

2 nmol/L to 300 nmol/L (higher concentrations may be determined after appropriate dilution).

3. INSTRUMENTATION

Perkin Elmer ZL-4100 with Zeeman correction.

4. DESCRIPTION

500 µL of diluant (Triton-X 0,4%, Magnesium nitrate 0,06 % and Ammonium phosphate 1 %) is pipetted into autosampler cups. 100 µL of blood is then added and mixed with the diluant solution. Aqueous calibration is performed.

5. PRECISION, ACCURACY AND DETECTION LIMIT

Target value (nmol/L)	Measured mean (nmol/L)	% RSD
38	36,8	4,8
105	104,4	3,8

Detection limit : 2 nmol/L.

6. NORMAL AND OCCUPATIONAL EXPOSURE LEVELS

General population : < 5 nmol/L (non-smokers)

10 – 80 nmol/L (smokers)

Alert level : 45 nmol/L.

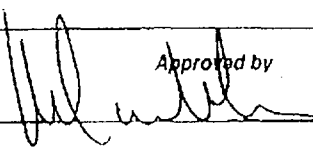
Action level : 135 nmol/L.

7. EXTERNAL PROFICIENCY TESTING PROGRAMS

➤ Centre de toxicologie du Québec.

8. REFERENCE (M-205-B)

Stoeppler, M. and Brandt, K., Contributions to automated trace analysis. V. Determination of Cd in whole blood and urine by electrothermal AAS, Fresenius Z. Anal. Chem., **300**, 372, 1980.

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